

James O. Wilkes

# **Fluid Mechanics for Chemical Engineers**

Prentice Hall International Series  
in the Physical and Chemical  
Engineering Sciences



# Fluid Mechanics For Chemical Engineers Wilkes

**C Cleary**



## **Fluid Mechanics For Chemical Engineers Wilkes:**

Fluid Mechanics for Chemical Engineers with Microfluidics and CFD. James O. Wilkes, 2006 This second edition contains extensive new coverage of both microfluidics and computational fluid dynamics systematically demonstrating CFD through detailed examples using FlowLab and COMSOL Multiphysics The chapter on turbulence has been extensively revised to address more complex and realistic challenges including turbulent mixing and recirculating flows Jacket *Fluid Mechanics for Chemical Engineers* James O. Wilkes, 2017-07-31 James O Wilkes has updated his expert hands on fluid mechanics tutorial with a complete introduction to the popular COMSOL Multiphysics 5.2 software package and ten new COMSOL 5.2 examples Building on the text that earned Choice Magazine's prestigious Outstanding Academic Titles award Wilkes offers masterful coverage of key fluid mechanics topics including computing turbulent flows bubble motion two phase flow fluidization microfluidics electro kinetic flow effects and computational fluid dynamics Throughout he presents more than 300 problems of incrementally greater difficulty helping students build mastery through realistic practice Wilkes starts with a macroscopic approach providing a solid foundation for sizing pumps and operating laboratory and field scale equipment The first four chapters derive equations needed to size chemical plant equipment including pipes in packed beds pumping installation fluid flow measurement filtration and cyclone separation Next he moves to a microscopic approach introducing key principles for modeling more advanced systems and solving industry or graduate level problems These chapters start with a simple derivation of the Navier Stokes equation NSE and then introduce assumptions for various flow geometries helping students reduce equations for easy solution analytically or numerically with COMSOL Updated COMSOL examples include boundary layer flow non Newtonian flow jet flow lathe flow lubrication momentum diffusion flow through an orifice plate parallel plate flow turbulent flow and more *Fluid Mechanics for Chemical Engineers* James O. Wilkes, Stacy G. Bike, 1999 Designed for undergraduate and first year courses in Fluid Mechanics this text consists of two parts four chapters on macroscopic or relatively large scale phenomena followed by eight chapters on microscopic or relatively small scale phenomena

**Introduction to Chemical Engineering Fluid Mechanics** William M. Deen, 2016-08-15 Designed for introductory undergraduate courses in fluid mechanics for chemical engineers this stand alone textbook illustrates the fundamental concepts and analytical strategies in a rigorous and systematic yet mathematically accessible manner Using both traditional and novel applications it examines key topics such as viscous stresses surface tension and the microscopic analysis of incompressible flows which enables students to understand what is important physically in a novel situation and how to use such insights in modeling The many modern worked examples and end of chapter problems provide calculation practice build confidence in analyzing physical systems and help develop engineering judgment The book also features a self contained summary of the mathematics needed to understand vectors and tensors and explains solution methods for partial differential equations Including a full solutions manual for instructors available at [www.cambridge.org/deen](http://www.cambridge.org/deen) this balanced textbook is the

ideal resource for a one semester course      **Fluid Mechanics for Chemical Engineers with Microfluidics and CFD, Second Edition** James Wilkes, 2005      **Physical Properties of Foods** Serpil Sahin, Servet Gülüm Sumnu, 2007-05-27 This book provides a fundamental understanding of physical properties of foods It is the first textbook in this area and combines engineering concepts and physical chemistry Basic definitions and principles of physical properties are discussed as well as the importance of physical properties in the food industry and measurement methods In addition recent studies in physical properties are summarized The material presented is helpful for students to understand the relationship between physical and functional properties of raw semi finished and processed food in order to obtain products with desired shelf life and quality      *Fluid Flow for Chemical Engineers* F. Holland, R. Bragg, 1995-03-17 This major new edition of a popular undergraduate text covers topics of interest to chemical engineers taking courses on fluid flow These topics include non Newtonian flow gas liquid two phase flow pumping and mixing It expands on the explanations of principles given in the first edition and is more self contained Two strong features of the first edition were the extensive derivation of equations and worked examples to illustrate calculation procedures These have been retained A new extended introductory chapter has been provided to give the student a thorough basis to understand the methods covered in subsequent chapters

**Introduction to Chemical Engineering Computing** Bruce A. Finlayson, 2014-03-05 Step by step instructions enable chemical engineers to master key software programs and solve complex problems Today both students and professionals in chemical engineering must solve increasingly complex problems dealing with refineries fuel cells microreactors and pharmaceutical plants to name a few With this book as their guide readers learn to solve these problems using their computers and Excel MATLAB Aspen Plus and COMSOL Multiphysics Moreover they learn how to check their solutions and validate their results to make sure they have solved the problems correctly Now in its Second Edition Introduction to Chemical Engineering Computing is based on the author's firsthand teaching experience As a result the emphasis is on problem solving Simple introductions help readers become conversant with each program and then tackle a broad range of problems in chemical engineering including Equations of state Chemical reaction equilibria Mass balances with recycle streams Thermodynamics and simulation of mass transfer equipment Process simulation Fluid flow in two and three dimensions All the chapters contain clear instructions figures and examples to guide readers through all the programs and types of chemical engineering problems Problems at the end of each chapter ranging from simple to difficult allow readers to gradually build their skills whether they solve the problems themselves or in teams In addition the book's accompanying website lists the core principles learned from each problem both from a chemical engineering and a computational perspective Covering a broad range of disciplines and problems within chemical engineering Introduction to Chemical Engineering Computing is recommended for both undergraduate and graduate students as well as practicing engineers who want to know how to choose the right computer software program and tackle almost any chemical engineering problem

**Fluid Mechanics and Heat Transfer** William Roy Penney, Edgar C. Clausen, 2018-01-31 This practical book provides instruction on how to conduct several hands on experiments for laboratory demonstration in the teaching of heat transfer and fluid dynamics It is an ideal resource for chemical engineering mechanical engineering and engineering technology professors and instructors starting a new laboratory or in need of cost effective and easy to replicate demonstrations The book details the equipment required to perform each experiment much of which is made up of materials readily available in most laboratories along with the required experimental protocol and safety precautions Background theory is presented for each experiment as well as sample data collected by students and a complete analysis and treatment of the data using correlations from the literature

**Modellierung und Simulation reibungsbehafteter Strömungen mit freier Oberfläche** Martin Lübke, 2017-10-25

**Computational Transport Phenomena for Engineering Analyses** Richard C. Farmer, Ralph W. Pike, Gary C. Cheng, Yen-Sen Chen, 2009-06-03 Although computer technology has dramatically improved the analysis of complex transport phenomena the methodology has yet to be effectively integrated into engineering curricula The huge volume of literature associated with the wide variety of transport processes cannot be appreciated or mastered without using innovative tools to allow comprehension

*Transport Phenomena in Micro Process Engineering* Norbert Kockmann, 2007-11-12 In this book the fundamentals of chemical engineering are presented aiming to applications in micro system technology microfluidics and transport processes within microstructures After a general overview on both disciplines and common areas recent projects are shortly presented The combination of different disciplines gives new opportunities in microfluidic devices and process intensification respectively Special features of the book are the state of the art in micro process engineering a detailed treatment of transport phenomena for engineers a design methodology from transport effects to economic considerations a detailed treatment of chemical reaction in continuous flow microstructured reactors an engineering methodology to treat complex processes The book addresses researchers and graduate students in the field of chemical engineering Microsystems engineering and chemistry

**Process Engineering and Industrial Management** Jean-Pierre Dal Pont, 2013-03-04 Process Engineering the science and art of transforming raw materials and energy into a vast array of commercial materials was conceived at the end of the 19th Century Its history in the role of the Process Industries has been quite honorable and techniques and products have contributed to improve health welfare and quality of life Today industrial enterprises which are still a major source of wealth have to deal with new challenges in a global world They need to reconsider their strategy taking into account environmental constraints social requirements profit competition and resource depletion Systems thinking is a prerequisite from process development at the lab level to good project management New manufacturing concepts have to be considered taking into account LCA supply chain management recycling plant flexibility continuous development process intensification and innovation This book combines experience from academia and industry in the field of industrialization i e in all processes involved in the conversion of research into

successful operations Enterprises are facing major challenges in a world of fierce competition and globalization Process engineering techniques provide Process Industries with the necessary tools to cope with these issues The chapters of this book give a new approach to the management of technology projects and manufacturing Contents Part 1 The Company as of Today 1 The Industrial Company its Purpose History Context and its Tomorrow Jean Pierre Dal Pont 2 The Two Modes of Operation of the Company Operational and Entrepreneurial Jean Pierre Dal Pont 3 The Strategic Management of the Company Industrial Aspects Jean Pierre Dal Pont Part 2 Process Development and Industrialization 4 Chemical Engineering and Process Engineering Jean Pierre Dal Pont 5 Foundations of Process Industrialization Jean Fran ois Joly 6 The Industrialization Process Preliminary Projects Jean Pierre Dal Pont and Michel Royer 7 Lifecycle Analysis and Eco Design Innovation Tools for Sustainable Industrial Chemistry Sylvain Caillol 8 Methods for Design and Evaluation of Sustainable Processes and Industrial Systems Catherine Azzaro Pantel 9 Project Management Techniques Engineering Jean Pierre Dal Pont Part 3 The Necessary Adaptation of the Company for the Future 10 Japanese Methods Jean Pierre Dal Pont 11 Innovation in Chemical Engineering Industries Oliver Potier and Mauricio Camargo 12 The Place of Intensified Processes in the Plant of the Future Laurent Falk 13 Change Management Jean Pierre Dal Pont 14 The Plant of the Future Jean Pierre Dal Pont

Biofluid Dynamics Clement Kleinstreuer, 2016-04-19 Biofluid Dynamics builds a solid understanding of medical implants and devices from a bioengineering standpoint The text features extensive worked examples and mathematical appendices exercises and project assignments to stimulate critical thinking and build problem solving skills numerous illustrations including a 16 page full color insert computer simulations of biofluid dynamics processes and medical device operations tools for solving basic biofluid problems and a glossary of terms The text can be used as a primary selection for a comprehensive course or for a two course sequence or as a reference for professionals in biomedical engineering and medicine

**Fluid Mechanics for Chemical Engineers** Noel de Nevers, 2005 Fluid Mechanics for Chemical Engineers third edition retains the characteristics that made this introductory text a success in prior editions It is still a book that emphasizes material and energy balances and maintains a practical orientation throughout No more math is included than is required to understand the concepts presented To meet the demands of today s market the author has included many problems suitable for solution by computer Two brand new chapters are included The first on mixing augments the book s coverage of practical issues encountered in this field The second on computational fluid dynamics CFD shows students the connection between hand and computational fluid dynamics

Teaching and Learning of Fluid Mechanics Ashwin Vaidya, 2020-12-02 This book contains research on the pedagogical aspects of fluid mechanics and includes case studies lesson plans articles on historical aspects of fluid mechanics and novel and interesting experiments and theoretical calculations that convey complex ideas in creative ways The current volume showcases the teaching practices of fluid dynamicists from different disciplines ranging from mathematics physics mechanical engineering and environmental

engineering to chemical engineering The suitability of these articles ranges from early undergraduate to graduate level courses and can be read by faculty and students alike We hope this collection will encourage cross disciplinary pedagogical practices and give students a glimpse of the wide range of applications of fluid dynamics      *Transport Phenomena* Larry A. Glasgow, 2010-12-01 Enables readers to apply transport phenomena principles to solve advanced problems in all areas of engineering and science This book helps readers elevate their understanding of and their ability to apply transport phenomena by introducing a broad range of advanced topics as well as analytical and numerical solution techniques Readers gain the ability to solve complex problems generally not addressed in undergraduate level courses including nonlinear multidimensional transport and transient molecular and convective transport scenarios Avoiding rote memorization the author emphasizes a dual approach to learning in which physical understanding and problem solving capability are developed simultaneously Moreover the author builds both readers interest and knowledge by Demonstrating that transport phenomena are pervasive affecting every aspect of life Offering historical perspectives to enhance readers understanding of current theory and methods Providing numerous examples drawn from a broad range of fields in the physical and life sciences and engineering Contextualizing problems in scenarios so that their rationale and significance are clear This text generally avoids the use of commercial software for problem solutions helping readers cultivate a deeper understanding of how solutions are developed References throughout the text promote further study and encourage the student to contemplate additional topics in transport phenomena *Transport Phenomena* is written for advanced undergraduates and graduate students in chemical and mechanical engineering Upon mastering the principles and techniques presented in this text all readers will be better able to critically evaluate a broad range of physical phenomena processes and systems across many disciplines      MATLAB Applications in Chemical Engineering Chyi-Tsong Chen, 2022-05-20 This book addresses the applications of MATLAB and Simulink in the solution of chemical engineering problems By classifying the problems into seven different categories the author organizes this book as follows Chapter One Solution of a System of Linear Equations Chapter Two Solution of Nonlinear Equations Chapter Three Interpolation Differentiation and Integration Chapter Four Numerical Solution of Ordinary Differential Equations Chapter Five Numerical solution of Partial Differential Equations Chapter Six Process Optimization Chapter Seven Parameter Estimation Each chapter is arranged in four major parts In the first part the basic problem patterns that can be solved with MATLAB are presented The second part describes how to apply MATLAB commands to solve the formulated problems in the field of chemical engineering In the third and the fourth parts exercises and summary of MATLAB instructions are provided respectively The description of the chemical engineering example follows the sequence of problem formulation model analysis MATLAB program design execution results and discussion In this way learners are first aware of the basic problem patterns and the underlying chemical engineering principles followed by further familiarizing themselves with the relevant MATLAB instructions and programming skills

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*Advanced Transport Phenomena* P. A. Ramachandran, 2014-09-25 Integrated modern approach to transport phenomena for graduate students featuring examples and computational solutions to develop practical problem solving skills

**Membrane Filtration** Greg Foley, 2013-07-04 A hands on problem solving approach to the engineering of membrane filtration processes from microfiltration to reverse osmosis



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